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# PATENT SPECIFICATION

(11)

1 317 803

DRAWINGS ATTACHED

1 317 803

- (21) Application No. 37014/70 (22) Filed 30 July 1970  
 (31) Convention Application No. P 19 38 943.6  
 (32) Filed 31 July 1969 in  
 (33) Germany (DT)  
 (44) Complete Specification published 23 May 1973  
 (51) International Classification B01L 3/14 G01N 33/16  
 (52) Index at acceptance  
     B1X 14X  
     B8F 4C3 9X

(19)



## (54) SPECIMEN VESSELS AND CLOSURE CAPS THEREFOR

(71) We, SIEMENS AKTIENGESELLSCHAFT, a German Company, of Berlin and Munich, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to specimen vessels and the use of closure caps therefor to provide information regarding the contents of the vessels.

The constantly increasing number of clinical-chemical tests which need to be performed makes it desirable to employ automatic laboratory equipment which can control fully automatically the handling of specimens, for example performing tests on the specimens and recording the results of the tests.

In order to avoid confusion when an increasingly larger number of specimens has to be handled by a limited number of staff, it is known to attach to a holding device provided on a specimen vessel containing the specimen a short punched card bearing data, in an encoded form that is machine-readable, which are necessary for the identification of the specimen. One disadvantage of this method of identification resides in the fact that the punched card can easily be lost in, say, the centrifuging of the specimen and that additional means or manual operations are necessary for introducing the punched cards into a code-reading device for identifying the specimens in the vessels on the basis of the data on the respective associated cards. In order to obviate this disadvantage, it is known to us to provide a lug on an upper rim of a specimen vessel, which lug projects outwardly at a right angle to a central axis of symmetry of the vessel. Encoded information can then be applied to the lug. However, such outwardly projecting rigid lugs can cause difficulty in the handling of the vessels on which they are provided.

According to the present invention there is provided in combination with a specimen

vessel, a closure cap therefor formed with a sealing rim portion adapted to project into the interior of the specimen vessel so as to fit against an inner wall portion thereof, the cap being formed also with a further portion, extending so as to project externally of the vessel when the cap is fitted thereto, bearing machine-readable coded data in punched-hole form regarding the contents of the vessel.

The invention can for example be embodied in a specimen storage unit having at a storage location therein a number of specimen vessels having contents of different respective kinds, the unit including selection and delivery means operable to distinguish automatically between the specimen vessels, on the basis of machine-readable codings provided in punched-hole form on respective closure caps of the vessels to identify the contents thereof, so as to remove from the storage location, and supply to a delivery location, a specimen vessel having contents of a selected kind.

It will be appreciated that selection and delivery means which are operable to distinguish automatically between code-bearing articles at a storage location, and to transfer from that storage location to a delivery location an article that is of a selected kind identified by its coding, are not novel *per se*, and accordingly need not be described herein in greater detail. It is of course inherent in the nature of such selection and delivery means that they will incorporate some form of code-reading means and some form of article conveying means.

The application of machine-readable coded data to a closure cap of a combination embodying the invention and the sealing of a specimen in the associated specimen vessel by the cap can advantageously be performed in a single operation so that the relevant specimen-identifying data can be fixedly associated with the vessel without danger of their being lost.

In a preferred embodiment of the inven-

[Price 25p]

tion, the closure cap has a jacket part which fits over the associated specimen vessel so as to bear against outer wall portions thereof, and the coded data whereby the contents of the vessel are to be identified are punched onto the jacket part. Closure caps constructed in this form can be made particularly compact and stored in a space-saving manner.

10 In another embodiment of the invention, the closure cap may be constructed to have, on an outer face situated, for example, on the crown of the cap, a ring-shaped surface for the application of non-coded text corresponding to the coded data. Also, a part of the crown of the cap may be of reduced thickness relative to the rest of the crown so that a specimen can be withdrawn from the associated specimen vessel or introduced therein through a cannula or other means without the closure cap having to be removed. This area of reduced thickness can be a small region of the cap tapered to foil thickness.

25 As an alternative means of allowing the introduction or extraction of a specimen without removal of the closure cap of the relevant specimen vessel, a capillary aperture can be provided in the cap, into which aperture, for instance, a suitable cannula may be inserted.

30 With certain types of automatic laboratory equipment, a closure cap fitted onto a specimen vessel can be a hindrance to ready handling of the vessel. In a further embodiment of the invention, therefore, the crown of the closure cap for one specimen vessel can be provided with a recess, for example cylindrical in form, so that it is possible for another such specimen vessel to be received in the recess of the closure cap.

35 For a better understanding of the invention, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:—

40 Figure 1 shows a plan view and an elevational sectional view of a first form of closure cap of a specimen-vessel/closure-cap combination embodying the invention,

50 Figure 2 shows a plan view and a partially sectioned elevational view of a second form of such closure cap, and

55 Figure 3 shows a partially sectioned elevational view of a third form of such closure cap.

60 The closure cap shown in Figure 1 comprises a crown 1, adapted to cover a specimen vessel (not shown), and a sealing rim portion 2 defining a hollow cylinder which is adapted to project into the interior of the specimen vessel so as to bear under pressure against an inner wall portion thereof thereby providing fluid-tight sealing of a specimen within the vessel. The crown 1 of the cap is widened to form a flange extending

beyond the outside edge of the vessel to be closed. The free area thus obtained serves to bear machine-readable coded data in the form of groups of punched holes 3 which can be read by means of a suitable code-reading device and which provide information necessary for identification of the contents of the specimen vessel concerned by the code-reading device. A portion of the upper, external surface of the crown 1 of the cap, substantially in the dash-dotted region 4, may be employed to receive information in non-coded text corresponding to the coded data. A small region 5 in the centre of the crown 1 reduces to foil thickness, so that a cannula may be introduced into the vessel for feeding-in or extracting the specimen. Instead of a reduction in the thickness of the cap, a capillary aperture may be punched into the cap for the passage of the cannula. Such a capillary aperture has the advantage that a superatmospheric air pressure set up in the vessel when the cap is mounted can be vented.

65 In order that the individual groups of holes may be successively punched by means of a stationary code-applying device, a peripheral surface 6 of the crown 1 of the closure cap may be constructed as an annular slip-resistant rim surface such as a friction ring, so as to facilitate rotation of the cap about a central axis thereof, through angles corresponding to the spacing of the groups of holes, for the application of the coded data by the code-applying device or for the reading of the data by a stationary code-reading device.

70 The closure cap shown in Figure 2 differs from that shown in Figure 1 in that, instead of the flange-like widening of the crown 1 of the cap, there is provided a generally cylindrical jacket part 7 which is connected to the crown of the cap and which fits over the outside wall portions of the specimen vessel. The coded data serving to identify the contents of the vessel are in the form of groups of punched holes 3 in the jacket part which can be read by means of a suitable code-reading device. The jacket part 7 has a plurality of outer plane faces 8 arranged about a central axis of the jacket part such that the external cross-section thereof transverse to this axis is polygonal, this cross-section being seen in Figure 2 to have the form of a regular polygon, and the coded data are located at these outer plane faces. Layers 9 provided on the inside surface of the jacket part 7 serve for taking up manufacturing tolerances in the dimensions of the specimen vessel. The rim of the crown 1 is constructed as a toothed ring 10 which permits rotation of the cap through accurate angular distances because the periphery of the ring provides a generally annular slip-resistant rim surface. The crown 1 increases

in thickness from the toothed ring 10 inwardly to a ring-shaped portion 11, having an inclined upper surface, to which there may be applied information in non-coded text that can be read by sight. Situated within the ring-shaped portion 11 is a cylindrical recess 12 which can receive a further specimen vessel, so that the closure cap for one vessel may be employed as a stacking base for another, which may be necessary when working with certain kinds of automatic laboratory equipment. The remaining parts correspond to those of the cap shown in Figure 1 and are denoted by the same reference numerals.

The cap shown in Figure 3 has a particularly simple form of construction. The coded data are received on a raised cylindrical top portion 13 of the cap that extends from the crown 1 thereof. The top portion 13 may be employed to receive a specimen vessel for the same reasons as those mentioned in the preceding paragraph. Information in non-coded text may be applied in the region between the edge of the top portion 13 and the outside edge of the crown 1 of the cap. The remainder of the construction corresponds to that already described with reference to the caps shown in Figures 1 and 2.

#### WHAT WE CLAIM IS:—

1. In combination with a specimen vessel, a closure cap therefor formed with a sealing rim portion adapted to project into the interior of the specimen vessel so as to fit against an inner wall portion thereof, the cap being formed also with a further portion, extending so as to project externally of the vessel when the cap is fitted thereto, bearing machine-readable coded data in punched-hole form regarding a specimen to be contained in the vessel.

2. A combination as claimed in Claim 1, wherein the said further portion is provided by the crown of the cap.

3. A combination as claimed in Claim 1, wherein the said further portion is a raised top portion of the cap that extends from the crown thereof.

4. A combination as claimed in any preceding claim, the cap having an annular slip-resistant rim surface portion for facilitating rotation of the cap.

5. A combination as claimed in Claim 4, wherein the said rim surface portion is constituted by the periphery of a toothed ring provided on the cap.

6. A combination as claimed in any preceding claim, the cap being provided with a

surface portion for the application of non-coded text.

7. A combination as claimed in Claim 6, wherein the surface portion provided for the application of non-coded text is annular and is located on an upper external face of the cap.

8. A combination as claimed in any preceding claim, wherein a part of the crown of the cap is of reduced thickness relative to the rest of the crown so as to facilitate the passage therethrough of means for introducing a desired specimen into such a specimen vessel or for extracting a desired specimen therefrom.

9. A combination as claimed in Claim 8, wherein the said part of the crown is a small region which is of foil thickness.

10. A combination as claimed in any one of Claims 1 to 8, the cap having a capillary aperture therein whereby the interior of such a specimen vessel can communicate with the exterior.

11. A combination as claimed in any preceding claim, the cap being provided with a recess in its crown so that a further such specimen vessel can be received in the recess of the cap.

12. A combination as claimed in Claim 11, wherein the said recess is substantially cylindrical.

13. A combination as claimed in any preceding claim, wherein the cap is provided with a jacket part which is adapted to fit over the specimen vessel so as to bear against an outer wall portion thereof, the said further portion of the cap being a portion of the said jacket part thereof.

14. A combination as claimed in Claim 13, wherein the outer surface of the said jacket part comprises a plurality of outer plane faces which are so arranged about a central axis of the jacket part that the external cross-section thereof transverse to the said central axis is polygonal, the said machine-readable coded data being located at the said outer plane faces.

15. A combination as claimed in Claim 13 or 14, wherein an interior surface of the said jacket part is lined with a layer of deformable material so as to allow for manufacturing tolerances in the dimensions of the specimen vessel.

16. A combination as claimed in any preceding claim, wherein the specimen vessel contains specimen material and the said further portion of the cap bears such coded data relating to the specimen material.

17. In combination with a specimen vessel, a closure cap therefor substantially as hereinbefore described with reference to

any one of Figures 1, 2 and 3 of the accompanying drawings.

18. A combination as claimed in Claim 17, the vessel containing specimen material to which machine-readable coded data in punched-hole form borne on the cap relates.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1973.  
Published at The Patent Office, 25 Southampton Buildings, London WC2A 1AY  
from which copies may be obtained.

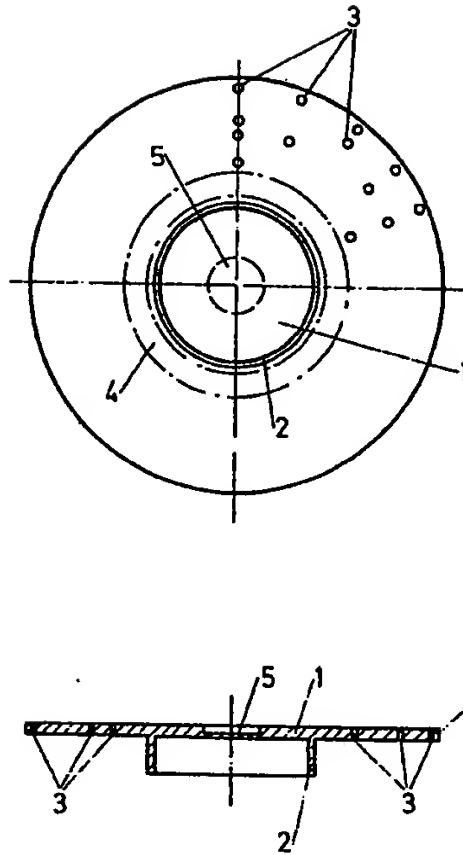


Fig.1

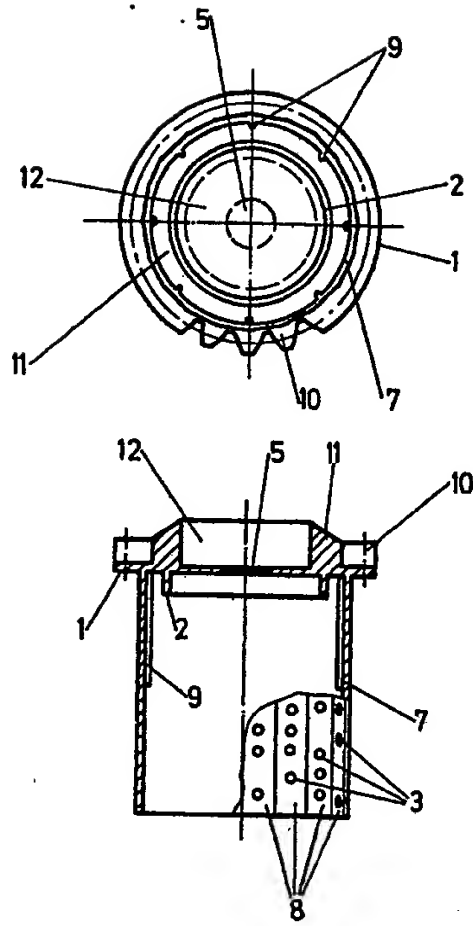


Fig. 2

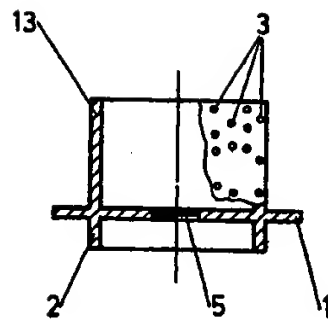


Fig. 3